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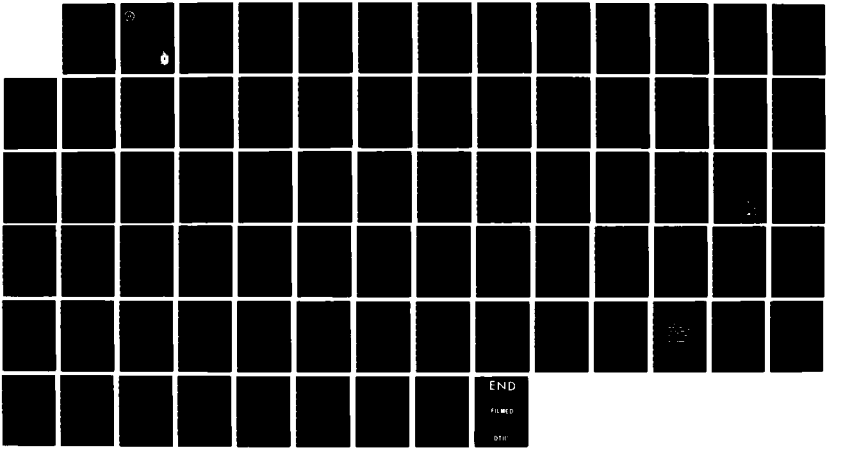

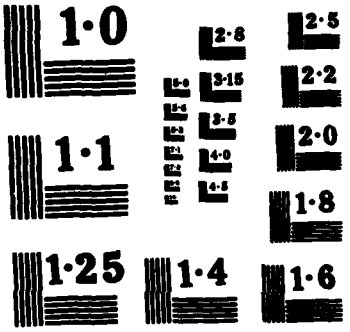

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REPORT TDI-TR-82-7

EVALUATION OF A VIDEODISC DELIVERY SYSTEM FOR TEACHING STUDENTS TO TROUBLESHOOT THE AN/VRC-12 MEDIUM-POWERED RADIO SERIES

FINAL REPORT

By: Francis J. King, PhD

31 OCTOBER 1982

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PREPARED FOR: *US Army Training And Doctrine Command*

Fort Monroe, Virginia 23651

NOTICES

This report has been reviewed and is approved.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objective of this test was to evaluate the training effectiveness and acceptability of the limited interactive consumer model videodisc player as a Training Delivery System in the MOS 31V10 Course, Tactical Communications System Operator/Mechanic. Specifically, random assignment was made of 235 trainees to two instructional groups: Seventy-two used the Videodisc Training Delivery System and 163 used the Slide-Tape Delivery System. Conclusions reached are that the Videodisc Training Delivery System was as equally or more effective, than the Slide-Tape Delivery

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Evaluation of a Videodisc Delivery System For Teaching Students to Troubleshoot The AN/VRC-12 Medium-Powered Radio Series*

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The views, opinions, and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other documentation.

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Evaluation of a Videodisc Delivery System For Teaching Students to Troubleshoot The AN/VRC-12 Medium Powered-Radio Series

Executive Summary

Random assignment was made of two hundred thirty-five trainees to two instructional groups. Regression analysis showed that those (n=72) using a videodisc delivery system to learn Task 17 (lessons 1-7 of Module 8) of the Tactical Communications System Operator/Mechanic Course reached the mastery criterion with a significantly lower mean progression index than that of trainees (n=163) learning the same materials with a slide-tape projector system. Videodisc trainees and instructors indicated (on questionnaires) a high degree of acceptance of the videodisc system, preferring it overwhelmingly to the slide-tape system. On Task 18 of the course, all trainees used the slide-tape system, and the videodisc trainees had a significantly greater mean completion time than that of the slide-tape group. It can be concluded that the videodisc system was superior to the slide-tape system in this situation, although the complexity of the study makes it impossible to explain the nature of the superiority of the videodisc system or to generalize it to other settings or even to the entire course. Reasons for the greater mean time of videodisc trainees when they resumed study with the slide-tape system were not discovered.

Because no scheduled maintenance was carried out and there was only one equipment failure during the data collection period, no comparison of the two systems for maintenance costs/problems was made.

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Evaluation of a Videodisc Delivery System For Teaching Students to Troubleshoot The AN/VRC-12 Medium-Powered Radio Series

Introduction

Background

It is widely recognized by the Army training community that as tasks required of military personnel become more complex, the need for increased effectiveness/efficiency in training programs becomes correspondingly more important. Educational technology offers one possible avenue to such increases, and studies of several kinds and combinations of instructional equipment are being undertaken at this time.

Videodisc systems appear to have great potential for improving training programs; however, in a study of performance of Armor, Artillery, and Infantry soldiers on pairs of Army Training Extension Course (TEC) lessons (Holmgren, Dyer, Hilligoss and Heller, 1979), this potential for superiority over another method of presentation (the Beseler Cue/See viewer) was not demonstrated. Review of the study indicated that this failure to show improved training effectiveness/efficiency with videodisc delivery may have resulted from three unrelated causes: frequent equipment and program malfunctions, short treatment times (only one hour), and small sample sizes.

The current study was designed to evaluate a videodisc training delivery system under conditions where the causes for failure listed above could not pertain. In addition to determining the training effectiveness/efficiency of the system, the study was designed also to evaluate the acceptability of the videodisc system to trainees and instructors as well as the reliability of the specific system used.

Purpose

The purpose of this document is to report the results of an evaluation study of a videodisc training delivery system used in teaching students to troubleshoot the AN/VRC-12 medium-powered frequency modulated (FM) radio series. The videodisc system used nonprogrammable Magnavox VH8000 consumer videodisc players. The instructional module on medium-powered FM radios is the eighth in a series of fourteen modules that make up the entire Tactical Communications System Operator/Mechanic Course (MOS) 31V10. This module contains fifteen lessons, two enabling examinations, and one criterion examination. The videodisc delivery system was used with only the first seven lessons in the module (Task 17). They were tested with one of the two enabling examinations.

The objectives of the evaluation were to determine the training effectiveness/efficiency of the videodisc system, its acceptability to students and instructors, and the reliability of its equipment. Specific evaluation questions were asked concerning the first two, training effectiveness/efficiency and student and instructor acceptance; acceptability of the system and equipment reliability were evaluated by use of questionnaires and records.

The use of highly specific questions in evaluation or comparison of the instructional effectiveness/efficiency of different delivery systems serves to make the purposes of such evaluation/comparison entirely clear. Questions formulated for this study follow:

1. Will students who learn to troubleshoot medium-powered FM radios from the videodisc delivery system attain a statistically significantly lower mean progression index (PI)[1] than that attained by students who learn from the current system?

2. Will the difference in mean PI's of the two groups be of practical significance, i.e., will a treatment effect size of at least -.2 PI's be attained?

3. Will videodisc students have a statistically significantly higher mean on a knowledge retention test than that of students using the current system?

If the hypothesis of no difference between the PI means of the two groups were rejected at or beyond an alpha level of .05, these questions would be affirmatively answered. A treatment effect size of approximately .2 PI's or greater would indicate that adoption of the videodisc system for these lessons would be worthwhile.

4. Will there be statistically significantly fewer students in the videodisc system who are required to repeat the module than in the current system?

5. When asked to indicate the degree of acceptance of the system used for the first seven lessons of the medium-powered FM radio series, will students who receive training with the videodisc system express statistically significantly greater acceptance than will students who receive training with the current system? (This question was to compare acceptance of the same lessons with different systems and different subjects.)

6. Will students who experience both the videodisc and the current delivery system express greater satisfaction with the videodisc system? (This question was to compare acceptance of different lessons with different systems and the same subjects.)

Questions 3, 4, and 5 would be considered affirmatively answered if hypotheses of no differences between proportions or means were rejected

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[1]The PI is the amount of active time taken by a student to complete the lessons in a task divided by the assigned time allotted for successful completion of that task. Active time is time actually spent in learning the material.

at or beyond alpha levels of .05.

7. Will the instructors who supervise students undergoing instruction in either videodisc or current systems express greater satisfaction and/or acceptance of the videodisc system than the current system?

This question was answered through a qualitative analysis of instructor responses to a questionnaire and to interviews. No statistical analysis was made of their responses because of the small number of instructors involved.

Evaluation Design

The target population for this study consisted of students who have recently finished basic combat training, who have normally ten or more months of active duty service remaining after completion of the course, and who have electronic aptitude scores of at least 90 on the Armed Services Vocational Aptitude Battery (ASVAB). Two hundred thirty-five students from this population were used in the evaluation study; 72 of them were randomly assigned to receive training via the videodisc system while the other 163 used the current system. The unequal numbers resulted from the fact that only 8 videodisc training positions were available while there were 19 current system training positions. Two backup positions equipped with videodiscs were available to be used in case of equipment failure or for either videodisc or control students if either set of available positions were fully occupied.

It was originally planned to obtain 100 students for the videodisc treatment and approximately 224 students for the comparison (covariate) treatment. These numbers were calculated, given an estimated effect size of -.2 PI's (a difference in mean student learning time of about five hours), alpha = .05, and statistical power of .80.[2] Because of time pressures, the total number required could not be obtained.

Training conditions. The current Tactical Communication System Operator/Mechanic Course is a self-paced program that utilizes an Individual Learning Center (ILC), a set of radio and basic electronics laboratories, and three testing rooms. The learning center is equipped with a number of student carrels, each containing a Caramate slide-tape projector; the laboratory that is concerned with the eighth module contains a number of AN/VRC-12 radios whose components can be modified to exhibit various defects; and the related testing room contains radios identical to those in the laboratory.

Upon entering the program, a student is issued a Student Guide

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[2] J. Cohen, Statistical Power Analysis For The Behavioral Sciences. (New York: Academic Press, 1969).

that acquaints him with the program and the procedures to be followed. Using a printed Guidance Package for the appropriate module, the student works through a lesson by receiving instruction from the Caramate and by completing a series of written and/or laboratory exercises. Enabling examinations are administered to the student at the end of each lesson or set of lessons by an instructor in the ILC, laboratory, or testing room, and a decision is made to determine whether the student will continue with the next lesson or repeat the current lesson or set. A criterion examination is administered in the testing room at the end of each module, at which time a decision is made as to whether each student will proceed to the next module or retake all or parts of the current one. Student progress is recorded in terms of a progression index (PI), which is the amount of time taken by the student to complete a task divided by the assigned time allotted for that task.

The videodisc delivery system was used for only the first seven lessons of the eighth module, and an enabling examination was given to each student at time of completion. The videodisc system differed from the currently used one in four ways. First, the videodisc equipment was used instead of the Caramate projector. Second, the videodiscs were placed in the laboratory and each of them was paired with an AN/VRC-12 radio. Third, the courseware, including the Guidance Package, for the seven lessons was completely rewritten to take advantage of the videodisc capabilities for fast and slow motion, freeze frame, and random access. The subject matter of the lessons did not change nor were the enabling tests or criterion exams changed. Fourth, an introduction to the videodisc system was presented to the student via printed material and the videodisc itself before the student began the first lesson. All other aspects of this portion of the course were the same.

Instrumentation. The major criterion or dependent variables used in the study were the previously defined progression index (PI) and scores on the enabling and criterion examinations. These variables were related in that students who received "no go's" on examinations had to retake all or parts of modules, thereby increasing their PI's. It was necessary, therefore, to be certain that these variables contained sufficient reliability and validity to be sensitive to differences in the two delivery systems.

Content validity is of primary concern when achievement or proficiency tests are under consideration. In assessing the content validity of a test, the following question is asked:

> Do the observations truly sample the universe of tasks the developer intended to measure or the universe of situations in which he would like to observe?[3]

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[3] L. J. Cronbach, "Test validation," in Educational Measurement (2nd ed.) ed. R. L. Thorndike. (Washington, D.C.: American Council on Education, 1971.)

The question is answered by assessing the adequacy of the set of operations used in test construction. These operations include defining the domain or universe of interest, specifying the procedures for sampling the domain and for stimulus and response construction, planning the materials and instructions given by examinees, and formulating the rules by which the responses are evaluated.

The first seven lessons in the eighth module are concerned with six pieces of equipment that can fail in one or more ways and that make up an AN/VRC-12 series radio. The six pieces of equipment and the number of their possible defects are as follows:

AN/VRC-12 Radio Equipment		No. of Possible Defects
CS 4720	Cable	2
MT 1029	Mounting platform	1
RT	Receiver transmitter	3
CX 4722	Cable	3
MX	Matching unit for antenna	3
Source		1
		13

The enabling examination consists of supplying the student with an Equipment Inspection and Maintenance worksheet (Form DA 2404), assigning him to a radio with known defects, requiring him to discover its deficiencies, and requiring him to indicate corrective actions. The student must correctly identify deficiencies and prescribe proper corrective action for at least two of three problems. One problem must involve the matching unit (RT, CX 4722, MX), one must involve the power input (source, CX 4720, MT 1029, RT), and the third is chosen by the examiner. It is highly likely that if a student can solve two problems he can deal with all the problems in the domain since a common procedure is involved in all of them. Well defined, objective rules for evaluating the student's performance exist. Thus, while no formal studies of inter-examiner reliability were made, it is believed that agreement between examiners concerning scoring is sufficiently high for the purposes of the evaluation study.

The discussion above indicates that the enabling exam for the first seven lessons on the AN/VRC-12 has high content validity; however, there could be some question about the stability of the PI. That is, the active study time for a student could be influenced by many temporary factors (e.g. changes in motivational and emotional states, physical well-being, etc.) to the extent that fluctuations in it could make it insensitive to differences in the two delivery systems. As a check on this possibility, PI data were gathered on the first 7 and the next 5 lessons of the AN/VRC-12 module for 29 graduates of the course. The Pearson product moment correlation between the two PI variables was .73. This moderately high degree of agreement between PI's taken at two different times suggests that the

stability of the PI is probably sufficiently great to allow it to detect differences in the two delivery systems.

Concerns about content validity of the enabling examination which follows the second set of lessons in the module, and the criterion examination which is administered to students when they have completed the module are the same as those for the first enabling exam. The rationale given above would thus apply equally to these tests.

Since there could be some question about the ability of the pass/fail score of the enabling exam and the PI to detect differences in the two delivery systems a knowledge retention test was developed and used as a criterion variable. This test contained 40 items selected from exercises in the guidance packages. The table given below shows for the first seven lessons in the current AN/VRC-12 radio guidance package the number and proportion of potential test questions each contains and the number of questions which were chosen from each lesson through proportional random sampling procedures.

	Lesson							
	8-1	8-2-1	8-2-1.1	8-2-2	8-3	8-4-1	8-4-2	Total
Number of Questions	16	9	6	19	45	22	22	139
Proportion	.12	.06	.04	.14	.32	.16	.16	1.00
Number of Test Items	5	2	2	6	13	6	6	40

Figure 1. Distribution of Knowledge Retention Test Items

This test appears to meet the operational criteria for high content validity. It was designed after the videodisc courseware had been developed and was constructed in such a way as to have high content validity for both sets of courseware. A copy of it is given in Appendix A.

The three instruments that were used in studying the human acceptance of the videodisc system are also presented in Appendix A. The first two are questionnaires that were administered to students, one to those who learned from the Caramate delivery system and the other to those who used the videodisc system. The third is a questionnaire for instructors.

Items 1 - 17 on the student questionnaires were identical except for location designation, and scores on them were used to compare acceptance of the two systems. Individual item responses were used to help explain differences in effectiveness that might occur. Items 18 - 21 on the Caramate student questionnaires to discover whether there were factors in the physical environment in the ILC that could possibly have affected learning efficiency.

Each of items 18 - 27 on the questionnaire for videodisc students was examined separately in studying the relative acceptability of the two systems. Both of these instruments were administered to students who passed the enabling exam on the first seven lessons of the AN/VRC-12 radio. Administration of them was carried out by instructors in the ILC before students begin the next set of lessons. The questionnaire for lab instructors was completed at the end of the 10-week evaluation session. In addition, these instructors were asked to keep records of instances of unusual effectiveness or difficulty displayed by either system during the 10-week period.

Both student questionnaires are essentially expanded versions of one that was used in formative evaluation of this course. All three instruments provide space for informal comments for each item and for overall reactions.

In addition to the treatment classification, independent variables were education (highest grade completed) from the Report of Student Interviews (FS Form 412),self-estimate of reading ability from the Student Personal History (FS Form 58), and general technical (GT) and electronic aptitude (EL) scores on the ASVAB. These two forms are completed by all students when they enter the course. ASVAB scores were obtained from the students' personnel records.

Design. A true experimental design was employed in the evaluation study since students were randomly assigned to treatments. It is shown in diagrammatic form below:

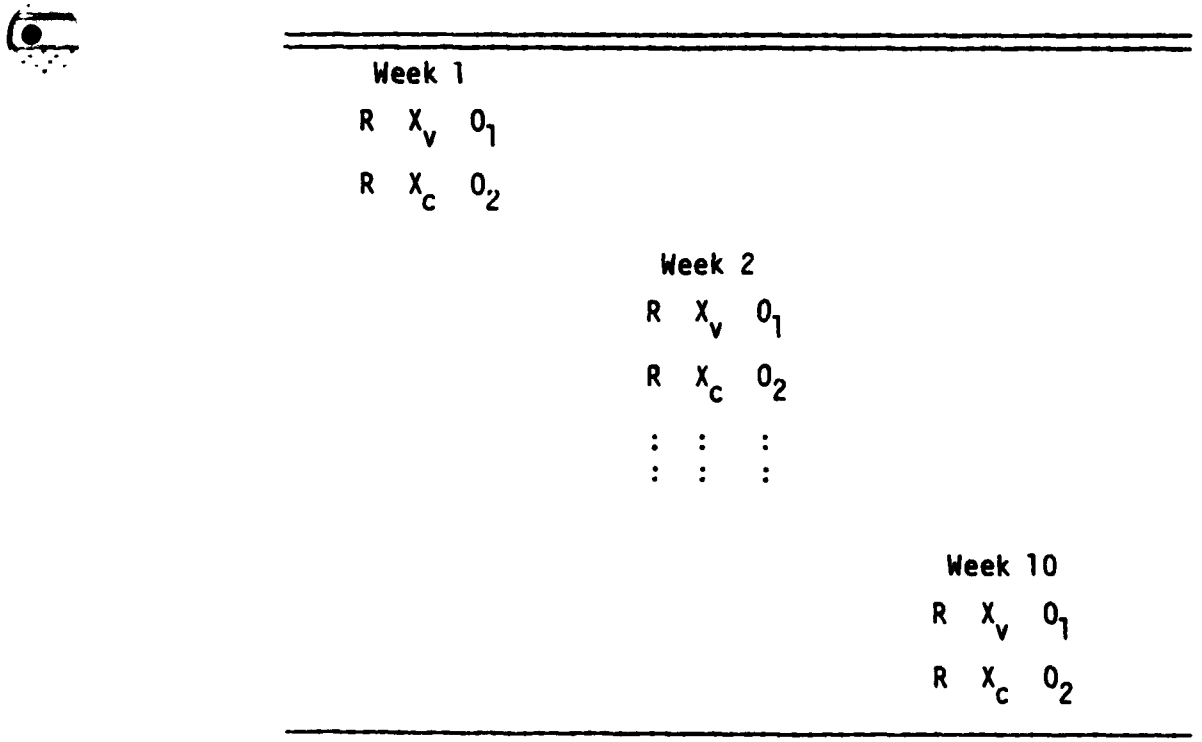

Figure 2. Experimental Design

In the diagram, R indicates random assignment to either the videodisc system (X_V) or the Caramate system (X_C), and O_1 and O_2 are the criterion variables taken for each group. The design was repeated for 10 weeks until 72 students had received training on the videodisc system and 163 had received training with the Caramate system.

Data Collection and Verification

Current kinds of data and methods of collection with only a few changes were adequate for evaluation purposes. At the beginning of each module, each student was issued a student guidance card (FS Form 1051) on which the instructor recorded pass/fail data and beginning and ending times for each lesson. These forms were collected for the entire ten-week course and were used to construct data files. Three computer-generated reports were produced from these files. The first, and most important for the evaluation, reports for each student the time he spent on each of 31 tasks which are made up of blocks of lessons followed by enabling or criterion examinations. This report also includes the average time spent on each task by all the students in the class and the assigned time for each task. The second report (Class Status Roster) gives for each student for the total course, the PI, status (Graduated, Failed, still in progress), number of tasks completed and the date of the last task completed. It then gives the assigned time for the number of tasks completed, the average time of all students in the class, the active and administrative times for each student, and the estimated number of days to graduation. The third report (Current Status Report) is a summary of the performance of a series of classes. It lists for each class the class number, the starting data, the number of starting and remaining students, the number and percentage of students relieved because of administrative or academic reasons, the number and percentage of turnbacks, the number and percentage of graduates, the average number of days and hours to graduation, and the total number and percentage of reliefs.

In addition to the basic data provided by the guidance cards, examination results were kept by the AN/VRC-12 examiner. These consisted of the equipment inspection and maintenance worksheets (Form DA 2404) and pass/fail logs. These data together with the report of student interviews (FS Form 412) and the student personal history (FS Form 58) were retained for evaluation of students. Copies of all forms and the first computer-generated report are shown in Appendix B. Forms for gathering reliability, maintainability and cost data for the videodisc equipment are shown in Appendix C.

Data that were gathered for evaluation purposes only were scores on the knowledge retention test taken by students upon passing the enabling exam on the first seven lessons of the AN/VRC-12 and the student and instructor questionnaires.

Two data files were prepared. The first contained for each student an ID number and/or name; group membership (1 if a member of the videodisc group, 0 otherwise); highest grade of school completed; student estimate of reading ability (codes 1 through 4); ASVAB GT and EL scores; active

student times for the first seven lessons of the AN/VRC-12 module (Task 17), the second five lessons of the module (Task 18), and the last three lessons of the module (Task 19); pass/fail scores on the enabling and criterion exams of the AN/VRC-12 radio; total score (number correct) on the knowledge retention; and total scores from items 1 - 17 on the student questionnaire. This data file was entered directly into the computer through a terminal from the data collection form. The second data file was constructed from the student questionnaires. The file was made with individual item responses in columns 1 - 32 for the Caramate students and columns 1 - 43 for the videodisc students.

The following verification procedures were used after any data collection step involving computation, recording, or file preparation by hand: (1) Select a random sample of approximately 10% of the data set. (2) Have a person who did not do the original work recompute or re-record the data from the sample. (3) If more than 2% errors are found (disregarding round-off and other minor errors) check each data record and correct errors. (4) Check each student time for Tasks 17, 18, and 19 that deviate markedly from the assigned time. Deviant scores were examined for recording or computation errors and corrected if necessary.

Data analysis. Regression analysis[4] was the major method used in analyzing the data. Its purpose was to determine the statistical significance of the difference between the mean PI's of the two groups while holding the effect of amount of education constant. The basic model employed is shown below:

$$\hat{Y} = a + b_1X_1 + b_2X_2 + b_3X_3$$

where $\hat{Y}$ is the predicted value of a criterion variable, X_1 is the dummy coded group membership variable (videodisc = 1, Caramate = 0, X_2 is the education score from the Report of Student Interviews,[5] X_3 is the interaction of the two independent variables (X_1X_2), the b's are regression coefficients, and a is a constant. The first analysis used the PI for Task 17 as the dependent variable and the data were fitted to the model. The statistical significance of b_3 was checked using an F-test; since it was not different from zero, that term was dropped. The analysis was redone using as the basic model $\hat{Y} = a + b_1X_1 + b_2X_2$, and the significance of b_1 was determined. Since b_1 was negative and nonzero, the videodisc system was declared to be more effective than the current system. Of secondary interest was the statistical significance of b_2; it was nonzero,

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[4]Kerlinger, F. N. and Pedhazur, E. J., Multiple Regression in Behavioral Research. (New York: Holt Rinehart and Winston, 1973.)

[5]In the original evaluation plan ASVAB-GT was specified as the covariate in the regression analysis. Because GT scores for forty-nine subjects could not be obtained, it was decided to substitute years of education as the covariate.

and the conclusion was that the magnitude of PI is related to the educational attainments of the subjects. Since both b_1 and b_2 were significant, the basic equation was decomposed to yield an equation for each group. For the videodisc group it was $\hat{Y} = (a+b_1) + b_2X_2$, and for the Caramate group it was $\hat{Y} = a + b_2X_2$. Thus, b_1 can be interpreted as the difference between the means of the two groups adjusted for initial group differences in educational level.

Patterns of correlations among the independent variables were examined. It did not appear that by using one or more of the other independent variables, significant increments in the amount of explained variance of the dependent variable would be attained.

The second and third regression analyses used as dependent variables total scores on the knowledge retention test and total scores on the first seventeen items on both student questionnaires. Chi-square tests[6] were used to test differences in pass/fail frequencies on the enabling exam and to determine differences in frequencies of responses to items that compare the videodisc and Caramate systems where appropriate.

Additional analyses used the basic regression model to test for system transfer effects using as the dependent variable the PI of the second set of lessons on the AN/VRC-12 radio (Task 18).

Discussion

Conduct of the Study

Project start-up procedures included designation of a person responsible for seeing that necessary data were collected and stored for later shipment to the evaluator, accumulation of Class Status Rosters and Current Status Reports for later use as comparison data, briefing of participating personnel on the videodisc system and the evaluation project, and delivery to participating personnel of necessary forms and instructions for their use. FS Forms 412 and FS Forms 58 were collected for all students in participating classes.

Assignment to the videodisc or the Caramate group was made for participating students at the time they passed the criterion examination for module seven. A previously determined random assignment schedule was used for this purpose. Group assignments were recorded on FS Forms 1051 and also on Class Rosters for the Evaluation Study.

When each participating student passed the enabling examination for Task 17, both the knowledge retention test and the appropriate questionnaire were administered. Test scores and completed questionnaires

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[6]See any basic statistics text; for example, A. L. Edwards, Statistical Analysis, 4th ed. (New York: Holt Rinehart and Winston, 1974).

were stored. In addition, ASVAB GT and EL scores were obtained and stored on appropriate forms for all students who entered the program, regardless of whether they completed it.

For each participating class, the following data sources were obtained and stored:

(1) DA Forms 2404 for Tasks 17, 18, and 19
(2) Pass/Fail rosters for Tasks 17, 18, and 19
(3) Originals of FS Forms 1051 for each student
(4) Verified computer printouts for each student
(5) Class status rosters

Following completion of the course by the last participating student, a printout of the current status report was obtained and stored. Checks were made to ensure that all participating classes were listed and that records were complete.

Lab Instructor questionnaires were administered and collected as soon as the last participating student passed the enabling examination for Task 17. Reliability and Maintenance and Cost Data Forms from maintenance personnel were collected at the same time.

Findings

The results of the study are presented in this section. Descriptive statistics are given first and are followed by the results of analyses specifically designed to answer the evaluation questions stated in the Purpose section. Selected computer output is given in Appendix D.

Table 1 gives the means and standard deviations of independent and dependent variables for both treatment and control groups. It can be seen that the randomization procedure produced groups that are reasonably equivalent on the independent variables--education, self-estimate of reading ability, ASVAB-GT, and ASVAB-EL. Although the Caramate group was slightly superior on each of the variables, none of the differences was statistically significant.

Table 2 gives the complete matrix of intercorrelations among all of the variables. The treatment variable has significant correlations with Active Time on Tasks 17 and 18 and with the acceptance measure. The correlations with Active Time on Task 17 and with acceptance are in the predicted direction and are indicative of statistically significant treatment effects. Further discussions of them are left for later sections. The remaining independent variables--education, self-estimate of reading level, and ASVAB GT and EL are all significantly correlated with each other and they all have significant correlations with Active Time on Task 17 and with the knowledge retention test. These results are as expected and attest to the correlational validity of both independent and dependent measures.

An internal consistency estimate of reliability (alpha) of .67 was obtained for the knowledge retention test using a combined random

Table 1

Means and Standard Deviations and Sample Sizes of Independent and Dependent Variables For Both Videodisc and Caramate Groups

Variable	Videodisc			Caramate		
	N	Mean	SD	N	Mean	SD
Education	72	11.79	1.53	162	12.02	1.21
Reading Estimate	72	2.43	.67	162	2.48	.65
ASVAB-GT	55	107.38	12.54	130	107.91	11.99
ASVAB-EL	55	109.47	10.74	130	110.98	11.72
Active Time Task 17	72	42.01	15.55	163	46.31	14.83
Active Time Task 18	70	27.97	8.99	158	25.20	6.91
Active Time Task 19	69	14.39	10.16	157	13.40	5.72
Fail Task 17	72	.20	.40	163	.19	.40
Fail Task 18	72	.03	.17	163	.06	.22
Fail Task 19	72	.04	.20	163	.04	.19
Knowledge Retention	72	44.46	5.61	163	44.81	4.86
Acceptance Questions	72	15.21	1.99	163	13.61	2.20

Table 2

Intercorrelations of All Variables

	Treat-ment	Educa-tion	Read-ing Est.	ASVAB GT	ASVAB EL	Time 17	Time 18	Time 19	Fail 17	Fail 18	Fail 19	Know-ledge	Accept-ance
Treatment	--	-.08	-.04	-.02	-.06	-.13*	.17*	.06	.00	-.06	.01	-.03	.32*
Education		--	.18*	.32*	.22*	-.12*	-.04	.05	-.11*	-.08	-.03	.14*	-.07
Reading Est.			--	.23*	.13*	-.14*	-.02	.02	-.06	-.03	-.11*	.12*	.01
ASVAB-GT				--	.71*	-.25*	-.21*	.02	-.17*	-.07	-.14*	.40*	.17*
ASVAB-EL					--	-.29*	-.32*	.02	-.23*	-.10	-.11	.26*	.03
Time 17						--	.31*	.01	.42*	.04	-.01	-.14*	-.22*
Time 18							--	.07	.03	.24*	.01	-.05	.02
Time 19								--	.07	.20*	.01	.03	.00
Fail 17									--	.09	-.10	-.08	-.08
Fail 18										--	-.04	-.05	.03
Fail 19											--	-.11*	.01
Knowledge												--	.17*
Acceptance													--

* Alpha less than or equal to .05

sample of 50 slide-tape students and 25 videodisc students. Six of the 40 items had multiple responses so that the highest possible total score was 59. An alpha reliability coefficient of .64 was obtained for the 17 common items of the acceptance questionnaire. The total sample (n=235) was used for this computation.

Evaluation Question #1. Will students who learn to troubleshoot medium-powered FM radios from the videodisc delivery system attain a statistically significantly lower mean progression index (PI) than that attained by students who learn from the current system?

The PI was computed by dividing the Active Time on Task 17 for each soldier by 26.18, the assigned time for the task. It was regressed on the dummy coded treatment variable (T), the education variable (E), and the interaction of treatment and education (TE). An F-ratio was computed on the difference between the squared multiple correlation of this model (.043) and one based on only T and E (.035) and was found not to be significant at the .05 level. The interaction term was not significant and the second model was retained. The results for it are shown in Table 3. The regression coefficients for both T and E were significant at less than the .05 level and the coefficient to T shows the adjusted difference in mean PI's for the two groups. The first evaluation question, then, can be answered affirmatively.

Table 3

Regression Coefficients, Standard Errors, F-Ratios, Levels of Statistical Significance and Multiple Correlation For The PI of Task 17 (N=234)

Variable	B	S.E.B	F	Sig.
Treatment	-.178	.081	4.77	.03
Education	-.060	.029	4.38	.04
Constant	2.489	.347	51.46	<.01
Multiple R	.19			

Evaluation Question #2. Will the difference in mean PI's of the two groups be of practical significance, i.e., will a treatment effect size of at least -.2 PI's be attained? The PI value of -.2 was selected as being of practical significance by project personnel and the evaluator. It represents an average saving in active student time of slightly more than five hours given the assigned time, 26.18 hours. While the actual value obtained, -.178, does not strictly meet the criterion for practical significance (the savings in time associated with it is 4.7 hours), it is sufficiantly close to answer the question affirmatively.

However, a complicating factor in the interpretation of the practical significance of the treatment effect lies in the results of the analysis of the Active Time on Task 18 as shown in Table 4. While no formal evaluation question was concerned with it or with Task 19, analyses of them were planned to determine whether transfer effects of the treatment were present. Table 5 shows that for Task 19 no significant effects were found. For Task 18, a regression analysis using treatment and education as independent variables found only a significant T effect. However, the regression coefficient for T shows that the actual active time on Task 18 for videodisc students was 2.77 hours longer than for Caramate students. There is no obvious reason for this result. Plausible interpretations are (1) that videodisc students suffered a loss of motivation upon returning to the Caramate presentation for Task 18, (2) that the use of instructional (the videodisc player) and laboratory (the radio) equipment in the same physical location allowed videodisc trainees to depend on the videodisc equipment for help in situations where Caramate trainees would have had to rely on memory or their own notes, thus reducing to some extent consolidation or overlearning by videodisc students of the knowledge, concepts, and skills presented in Task 17. The second interpretation would imply that videodisc trainees had, in a sense, to "catch up" with the Caramate group. Additional research is needed to determine the actual causes of this finding and to explore its implications in situations where efficiency in terms of reduced training time is desired.

Evaluation Question #3. Will videodisc students have a statistically higher mean on a knowledge retention test than that of Caramate students? A regression analysis of the knowledge retention test using treatment, education, and their interaction as independent variables failed to show significant treatment or T by E effects. These results are also shown in Table 6. This question, therefore, is answered negatively.

Evaluation Question #4. Will there be statistically significantly fewer students in the videodisc system who are required to repeat the module than in the current system? Approximately equal proportions of students in the two groups failed the enabling examinations for Task 17. A chi-square value of approximately zero was calculated from these data. In addition, chi-square values for differences in failure rates in the two groups for Tasks 18 and 19 were also near zero and nonsignificant. Therefore, this question is answered negatively.

Evaluation Question #5. When asked to indicate the degree of acceptance of the system used for the first seven lessons of the medium-powered FM radio series, will students who receive training with the videodisc system express statistically significantly greater acceptance than will students who receive training with the current system? A regression analysis of the acceptance measure with treatment, education and their interaction as independent variables revealed only a significant positive treatment effect. The results are shown in Table 7. This question is, therefore, answered affirmatively. As an aid in interpreting this question, the responses of both gtoups were tabulated and percentages of "yes" responses to them were calculated. These percentages and the sample sizes on which they were based are shown in Table 8. It should be remembered that the acceptance

Table 4

Regression Coefficients, Standard Errors, F-Ratios
Levels of Statistical Significance and
Multiple Correlations For The Active Time on Task 18 (N=225)

Variable	B	S.E.B	F	Sig.
Treatment	2.77	1.10	6.33	.01
Education	-.13	.38	.11	.74
Constant	26.62	4.66	32.57	<.01
Multiple R	.17			

Table 5

Regression Coefficients, Standard Errors, F-Ratios
Levels of Statistical Significance and
Multiple Correlations For The Active Time on Task 19 (N=225)

Variable	B	S.E.B	F	Sig.
Treatment	.98	1.06	.85	.36
Education	.31	.37	.69	.41
Constant	9.78	4.49	4.74	.03
Multiple R	.08			

Table 6

Regression Coefficients, Standard Errors, F-Ratios, Levels of Statistical Significance and Multiple Correlations For The Knowledge Retention Test (N=234)

Variable	B	S.E.B	F	Sig.
Treatment	-.20	.72	.08	.78
Education	.53	.25	4.41	.04
Constant	38.39	3.07	156.18	< .01
Multiple R	.14			

Table 7

Regression Coefficients, Standard Errors, F-Ratios, Levels of Statistical Significance and Multiple Correlations For The Acceptance Measure (N=234)

Variable	B	S.E.B	F	Sig.
Treatment	1.58	.31	26.90	< .01
Education	-.07	.11	.44	.51
Constant	14.46	1.30	123.64	< .01
Multiple R	.33			

Table 8

Sample Sizes and Percentages of Yes Answers Given To Acceptance Measure Items for Both Videodisc and Caramate Groups

	Videodisc		Caramate	
	No. Responding	% Yes	No. Responding	% Yes
1. Were you comfortable working with the videodisc in the Lab?	67	96	163	83
2. Was lighting adequate in the Lab?	67	100	166	95
3. Were you distracted by noise in the Lab?	66	21	164	15
4. Did you have enough space to work easily in the Lab?	66	62	165	67
5. Was the distance from the videodisc player about right?	67	96	155	93
6. Was it too close?	42	3	96	13
7. Was it too far away?	40	2	94	3
8. Were the written materials you used easy to understand?	64	96	159	82
9. Did they use too many unfamiliar words?	62	3	139	12
10. Were they confusingly organized?	62	12	139	26
11. Were the diagrams easy to use and understand?	67	96	166	93
12. Did the written materials and diagrams go together well for easy understanding?	67	94	161	87
13. Were all printed materials large enough and clear enough for easy use?	67	93	163	95
14. Were they too small?	59	9	125	8
15. Were they blurry or unclear?	56	2	125	10
16. Was the speed of the videodisc about right?	66	88	156	65
17. Did it go too fast?	55	2	121	10
18. Did it go too slowly?	55	16	125	46
19. Were you bored by the lessons?	66	12	156	60
20. Could you understand all that the speaker said?	67	87	159	54

Table 8 continued

	Videodisc		Caramate	
	No. Responding	% Yes	No. Responding	% Yes
21. Was his voice clear?	60	93	151	52
22. Did he use words that you did not know?	61	3	139	18
23. Did what the speaker said fit with what was being shown on the screen?	66	100	158	87
24. Did materials on the videodisc go well with the written materials you have for study and note taking?	67	93	165	87
25. Did you have to ask the instructor many questions?	66	23	162	32
26. Did you use reference notes when you worked on the actual radio sets in the Lab?	67	97	165	96
27. Did you make new notes as you worked?	64	69	150	69
28. Do you feel confident about your performance on the lessons you have completed?	66	97	162	91

measure was based on only the seventeen major questions in the table. The questions in Table 8 are those received by the videodisc students. The parallel questions asked of the Caramate students are not given.

Evaluation Question #6. Will students who experience both the videodisc and the current delivery system express greater satisfaction with the videodisc system? Videodisc students responded to fifteen questions comparing lessons that they took on the Caramate system with the ones they took on videodisc. The results are shown in Table 9, which states each question, the number of students who responded to it, the percentage of students who gave a yes answer to it, and the chi-square value associated with a 50:50 hypothesis concerning it. It can be seen from the table that students were generally very positive about the videodisc system in comparison with the Caramate.

Evaluation Question #7. Will the instructors who supervise students undergoing instruction in either videodisc or current systems express greater satisfaction and/or acceptance of the videodisc system than the current system? The three instructors who completed the questionnaire reported without exception that trainees preferred the videodisc to the Caramate delivery system. One commented that the videodisc system "holds the students' attention more completely" and that students were "disappointed" that the "entire course was not on videodisc."

Affirmative responses were obtained to questions related to adequacy of space and lighting for both systems, although one instructor commented that lighting was not entirely adequate for working on equipment.

Two of the three instructors reported Caramate students as requesting help more frequently than videodisc students, and two indicated that Caramate students made more notes for later use than did videodisc students.

Only one instructor said that one group seemed better able to "zero in" on specific problem areas than the other.

Answers to questions related to student confidence were split, with only one instructor reporting videodisc students to appear more "confident of their performance levels," while two of the three said that videodisc students had "greater confidence in handling the radio equipment in the Lab."

No statistical analysis could be made for such a small number of responses. However, a conclusion that instructor acceptance of the videodisc system is generally favorable seems to be warranted.

Reliability and maintainability of the videodisc system. During the entire trial period only one equipment failure (a laser slide) occurred after an elapsed time of 160.3 hours. This mechanical failure resulted in a critical mission stoppage for that machine. Nine days occurred between the failure and repair of the machine, with labor costs of $117.60, parts costs of $257.16, and administrative costs of $7.35. No scheduled maintenance was performed on any machine during the approximately ten weeks of operation.

Table 9

Responses of Videodisc Students to Questions
Comparing Videodisc and Caramate Lessons

	No. Responding	% Yes	Chi-Square
1. Did you like using the videodisc better than you liked using the Caramate?	67	90	41.93*
2. Did you think you learned more quickly with the videodisc	67	89	35.84*
3. Were diagrams as sharp and clear on the videodisc as on the Caramate?	65	94	24.99*
4. Did the physical movement (motion) on the videodisc player make course materials learned easier to understand than materials learned with the Caramate player, which has only still pictures?	66	96	54.55*
5. Did you use the backward motion capability of the videodisc to review or clarify course material?	67	91	45.15*
6. Did you find it helpful?	62	94	47.03*
7. Did you use the slow moving speed capability?	67	34	6.58*
8. Did you find it helpful?	54	43	.30
9. Did you use the rapid search of course material capability?	66	96	54.55*
10. Did you find it helpful?	64	98	60.06*
11. Did you use the videodisc when you were working on actual equipment?	67	72	12.55*
12. Did you also use reference notes?	66	94	50.97*
13. Did you make new notes at that time?	66	68	8.73*
14. Did you ask your instructor more questions when you used the videodisc than when you used the Caramate?	65	6	49.98*
15. Do you feel more confident about your performance on materials learned with the videodisc than on those learned with the Caramate?	65	89	29.50*

* Alpha equal to or less than .05

Summary/Conclusions

Training materials for Task 17, the first seven lessons of module eight of the fourteen module Tactical Communications System Operator/ Mechanic Course were administered to two groups of trainees using two different delivery systems. Specific materials used were concerned with troubleshooting medium-powered FM radios of the AN/VRC-12 series. One group of trainees used the current delivery system, which is a Caramate slide projector; the other group received instruction with a videodisc system. A total of 235 trainees were randomly assigned to groups, 72 to use videodisc equipment, and 163 to use the Caramate system. Relative training effectiveness/efficiency of the two systems was studied through comparison of mean progression indices, mean scores on a knowledge test, and proportion of trainees required to repeat the module for the two groups. Comparative acceptability of the systems was determined through administration of questionnaires to students in both groups and to instructors for the course.

Records of maintenance performed/equipment breakdowns repaired were kept for use in determining relative reliabilities and cost of maintenance for equipment for the two systems.

Trainees in the Caramate group used the delivery system normally in the individual learning center (ILC) and laboratories. Differences in training conditions for the videodisc group were that, 1) they received introductory instruction for using the equipment, 2) they used the different equipment, 3) they worked in the Lab with both videodisc equipment and the AN/VRC-12 radio, and 4) they used materials that had been rewritten to take advantage of special capabilities of the equipment. Content of the lessons and enabling and criterion examinations were the same for both groups.

Regression analysis was the major method used in analyzing data related to training effectiveness. Data from student questionnaires were also analyzed by this method. Instructor acceptance data were not subjected to statistical analysis because of the small number (3) of instructors involved.

Trainees who used the videodisc delivery system had a significantly lower mean PI on Task 17 than did trainees using the Caramate system; the net gain for videodisc trainees over Caramate trainees for Task 17 was 4.7 hours. However, on Task 18 videodisc students had a significantly greater mean completion time (2.8 hours). No significant differences between groups were found for either proportion of trainees required to repeat the module or mean scores on a knowledge test.

Both trainees and instructors showed high degrees of acceptance of the videodisc system, preferring it to the Caramate system. Only one equipment failure was reported, and no scheduled maintenance was performed during the comparison period. Thus, no results were obtained to indicate comparative costs/problems with maintaining the two systems.

While these results are somewhat equivocal, the overall conclusion is that the videodisc system was superior to the Caramate system in training

efficiency and acceptance, but that no evidence of its superiority in training effectiveness could be found. That is, trainees in the two groups achieved similar levels of knowledge of the course content and experienced similar success/failure rates. However, those in the videodisc group took significantly less time to complete the task and that time reduction closely approximated the level set to indicate practical importance. The fact that videodisc trainees took longer than Caramate trainees to complete Task 18 is of little importance if it can be interpreted to mean that students are less efficient when they are changed from a preferred system to a less preferred one. It is expected that similar results would be found if the study were to be repeated under the same conditions. Because of the complex nature of the study, the exact reasons for the superiority of the videodisc system cannot be determined. Therefore, generalizations about its effectiveness in other situations cannot be made. If, for example, the study were repeated with the ILC and the Lab combined for Caramate students as it was for videodisc students, the difference in mean PI's might disappear. Also, if the videodisc system were to be implemented for the whole course, its novelty effect would be reduced and the mean PI might be unaffected.

On the other hand, the superiority of the videodisc system could well be due to its greater flexibility in presenting course material. Over ninety percent of the videodisc students reported using the backward motion and rapid search features of the videodisc and finding them to be helpful features. It seems unlikely that these positive reports were due to the novelty of the system since only thirty-four percent of the trainees reported using the slow speed capability and only forty-three percent of those reported it to be helpful.

Recommendations

While this study was too limited to warrant a recommendation that the videodisc system be implemented for the entire course, it is valuable in that its results can be combined with those of other studies conducted under different conditions of setting, content materials, and trainee samples to arrive at more dependable conclusions. It is recommended that meta-analysis be used to evaluate the combined results of many studies such as this one to produce a broader and much more generalizable picture of the effectiveness of videodisc delivery of instruction. Special attention should be given to determining whether other studies contain evidence that training methods that increase efficiency by reducing training time also show evidence of possible reduction of knowledge/skills consolidation. If few or no studies have investigated this phenomenon, specific research designed to study it in training and situations involving job performance should be conducted. Finally, it is recommended that comparisons be made of the results of videodisc-alone studies with those of studies using other educational technologies, specifically studies of microcomputer-videodisc delivery systems, in order to determine the most cost-effective system for instruction of Army trainees.

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Appendix A

Knowledge Retention Test
Instructor Questionnaire

31V10 MOS

KNOWLEDGE RETENTION

TEST

MODULE:

LESSONS: 8-1
8-2-1
8-2-1.1
8-2-2
8-3
8-4-1
8-4-2

DIRECTION TO STUDENT: Answer all of the questions on this test. Do not refer to your Guidance Package or to any Technical Manual while taking the test. When finished, return your copy of the test to the Test Monitor.

Write your name and SSN below, along with the date.

Name: _____

SSN: _____

Date: _____

1. (4-4-5) T F With the R-442 in its NEW ON squelch mode, the CALL lamp will light when the receiver is turned <u>off</u> by the squelch circuit.

2. (4-4-1) T F The R-442 receives an FM signal in the same way as the receiver portion of the associated RT unit.

3. (7-1-2) T F One of the differences between matching units MX-6707 and MX-2799 is that the MX-6707 has a frequency selector knob.

4. (1-7-1) Which auxiliary component is used for relay operation when the radio set is an AN/VRC-45 or -49?

   a. AN/GRA-39
   b. C-2742
   c. C-2299
   d. MX-6707

5. (3-2-6) Responsibility of N.C.S. is:

   a. tactical control
   b. technical control
   c. direct control
   d. indirect control

6. (4-1-1) Put these preparatory steps in the proper order. Place a "1" by the step which is first and a "2" by the second, and so forth. Write your answers in this book.

   ___ Set the MX 6707 to the RT dial setting
   ___ Cable the RT to include the AN/URM-182
   ___ Preset the RT's controls
   ___ Verify the radio set's installation
   ___ Preset the R-442 controls
   ___ Turn all switches off to avoid injury

7. (1-7-3) Which auxiliary component is used to remote the radio set up to two miles using wire?

   a. AN/GRA-39
   b. C-2742
   c. C-2299
   d. MX-6707

8. (4-2-3) Match the terms in Column A with the description in Column B.

A. Terms	B. Descriptions
___ Squelch sensitivity	a. Lowering the audio level of a receiver when a transmitter is being keyed.
___ Call light	b. Refers to the amount of incoming signals required to automatically turn the receiver sound on.
___ Keying	c. A receive signal indicator.
___ Muting	d. Pressing the push-to-talk switch.

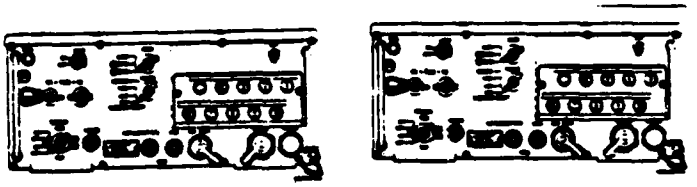
9. (4-4-3) T F The R-442 has two squelch modes: NEW ON--used when all radios of the net are capable of transmitting a 150 Hz tone and OLD ON--used when one or more of the radios of the net cannot transmit a 150 Hz tone.

10. (2-4-8) The best thing you can use to clean the audio plugs and jack is a:

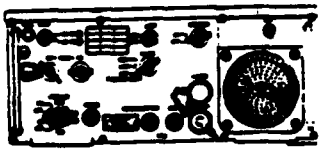
a. wet finger
b. silicon gel
c. pencil eraser
d. cleaning cloth

11. (1-6-2) What are the numbers for the following configurations of the AN/VRC-12 series?

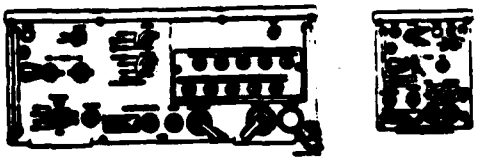
AN/VRC-_____a.



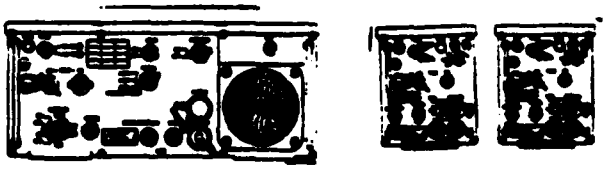
AN/VRC-_____b.



AN/VRC-_____c.



AN/VRC-_____d.



12. (1-5-9) Match the matching units in column B with the appropriate antenna system in column A.

Antenna system	Matching unit
_____ AT-912	a. MX-6707
_____ AS-1729	b. MX-2799
_____ R-442 antenna	c. AB-15

13. (2-7-4) Which auxiliary component is used to extend the audio accessories within the vehicle in which the radio set is mounted?

a. AN/GRA-39
b. C-2742
c. C-2299
d. MX-6707

14. (7-1-3) T F The MX-6707 and MX-2799 are two types of antenna matching units used with AN/VRC-12 series radios.

Freq MHz	Band	J2 Pin Designation						
		N	A	D	E	F	H	J
30–33	A	24	24	24	0	0	0	0
33–37	A	24	24	0	24	0	0	0
37–42	A	24	24	0	0	24	0	0
42–47.5	A	24	24	0	0	0	24	0
47.5–53	A	24	24	0	0	0	0	24
53–56	B	24	0	24	0	0	0	0
56–60	B	24	0	0	24	0	0	0
60–65	B	24	0	0	0	24	0	0
65–70.5	B	24	0	0	0	0	24	0
70.5–76	B	24	0	0	0	0	0	24

Refer to the pin voltage chart above and answer the following true and false questions.

15. (7-3-10) T F For proper operation of the matching units, pin N of J2 must have 22 to 30 VDC applied.

16. (7-3-11) T F With the RT's band switch in A or B, pin A of the MX-6707, J2, will have 22 to 30 VDC applied.

17. (4-2-2) Match the terms in Column A with the description in Column B.

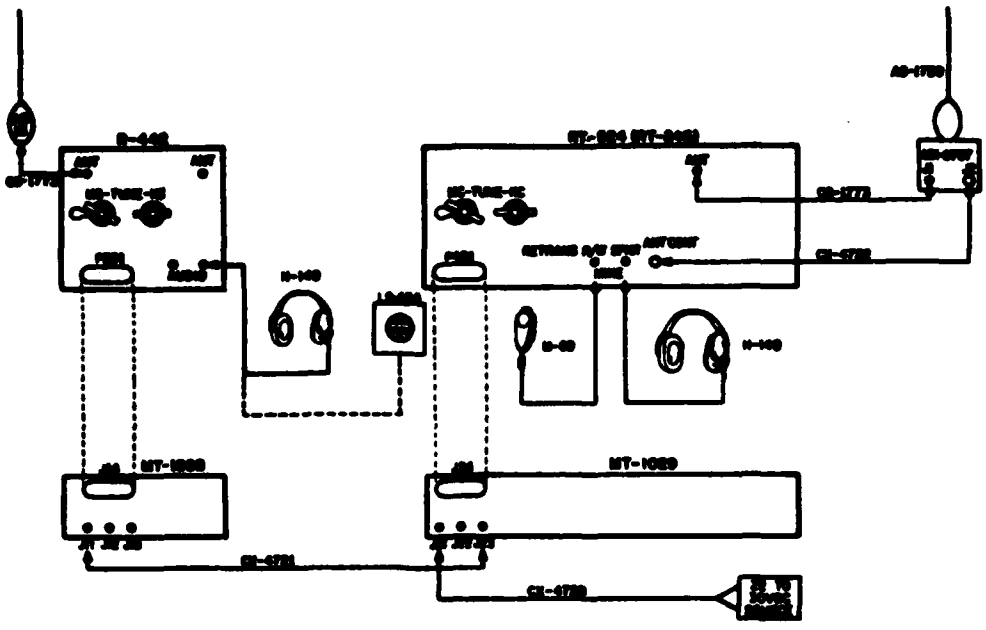
A. Terms	B. Descriptions
___ Power input	a. Listening to a radio signal.
___ Rushing noise	b. Automatically quieting a receiver when no radio signal condition exists.
___ Matching unit control	c. Sound used to initially check an FM receiver.
___ Squelch	d. The circuit that delivers battery voltage to the radio component.
___ Reception	e. That part of the RT's antenna system that changes the antenna tuning.

18. (7-1-1) The purpose of the matching units, MX-6707 and MX-2799, is to:

a. Tune the RT to a proper dial frequency.
b. Tune the antenna according to the RT's dial frequency.
c. Tune the receiver's antenna, AB-15.
d. Tune the receiver to a proper dial frequency.

19. (3-4-4) What is the phonetic alphabet equivalent for the letter "C"?

a. Cheerful
b. Charlie
c. Carbon



DIRECTION: Refer to the diagram of the AN/VRC-47 above to answer the following questions.

20. (7-2-1) Place an X by each component or cable that is part of the matching unit's DC control circuit.

____ MX-2799	____ CX-4722
____ MT-1029	____ MX-6707
____ R-442	____ CX-4721
____ RT-524 (RT-246)	____ CG-1773

21. (5-1-6) T F Cable CX-4720 is connected to the mount MT-1029 at jack J-23.

22. (5-2-7) T F Cable CG-1773 is connected between the RT-524 antenna coaxial jack and the antenna matching network coaxial jack.

23. (6-1-5) T F Within the MT-1029, the negative side of the source is connected to pin A of jacks J21, J22, J23, and J24.

24. (5-3-7) T F The RT-524 transmitted RF signal passes through cable CX-4722 to the antenna AS-1729.

25. (5-3-1) T F The microphone M-80 is normally connected to the audio jack labeled SPKR.

26. (6-1-8) T F To energize the RT's relay K404, a ground path must be completed from pin 2 of K404, through the contacts of the power switch.

27. (5-3-10) T F Cable CX-4722 is used to pass DC source voltage from the RT-524 to the AS-1729.

28. (5-3-5) T F The transmit signal patch for the RT-524 begins at the M-80.

29. (5-3-3) T F When the M-80 is keyed, the transmitter section relays should click and the blower motor should run.

30. (5-2-3) T F From the antenna jacks on the R-442 the signal passes through the receiver R-442 to the audio jacks on its front panel.

31. (6-1-3) T F For the mount MT-1029, the negative side of the starts at jack J21, pin A.

32. (5-3-9) T F DC source voltage is applied to different pins of the antenna control connector of the RT-524 as the frequency of the RT-524 is changed.

33. (6-3-1) T F Source voltage to the receiver, R-422, starts at the mount, MT-1029, jack, J22.

34. (5-1-3) T F Source voltage through cable CX-4721 is applied to the MT-1029.

35. (5-1-2) T F Source voltage from the MT-1029 is applied to the RT-524.

36. (6-3-4) T F Source voltage is applied to pin C of P201 through the receiver R-422 to light the dial lamp.

37. (5-2-2) T F Cable CG-1773 is connected to the coaxial connector of the mast base AB-15 to either antenna coaxial jacks on the R-442.

38. (6-1-6) T F The MT-1029's jack J24 mates with the RT's plug, P401, to apply source voltage to the RT (pins B and J).

39. (5-2-9) T F The audio accessory H-140 is normally connected to the mike jack labeled SPKR on the front panel of the RT-524.

40. (2-4-3) The RF cable CG-1773 is connected between the antenna jack on the AB-15 and:

a. the RF antenna jack of RT-524
b. the antenna control jack of RT-524
c. the left RF antenna jack of R-442
d. the right RF antenna jack of R-442
e. either one of the RF antenna jacks of R-442

For Caramate Delivery System Students (CDSS)

Please answer the following questions about the lessons you have completed with AN/VRC-12 Series Radio Sets:

1. Were you comfortable working in the Lab? Yes____ No____

   Comments: _____

   _____

2. Was lighting adequate in the Lab? Yes____ No____

   Comments: _____

   _____

3. Were you distracted by noise in the Lab? Yes____ No____

   Comments: _____

   _____

4. Did you have enough space to work easily in the Lab? Yes____ No____

   Comments: _____

   _____

5. Was the distance from the Caramate screen

   about right? Yes____ No____

   Was it too close? Yes____ No____

   Was it too far away? Yes____ No____

   Comments: _____

   _____

6. Were the written materials you used easy to understand? Yes____ No____

Did they use too many unfamiliar words? Yes____ No____

Were they confusingly organized? Yes____ No____

Comments: _____

_____

7. Were the diagrams easy to use and understand? Yes____ No____

Comments: _____

_____

8. Did the written materials and diagrams go together well for easy understanding? Yes____ No____

Comments: _____

_____

9. Were all printed materials large enough and clear enough for easy use? Yes____ No____

Comments: _____

_____

10. Was the speed of the Caramate about right? Yes____ No____

Did it go too fast? Yes____ No____

Did it go too slowly? Yes____ No____

Comments: _____

_____

11. Were you bored by the lessons? Yes____ No____

Comments: _____

_____

12. Could you understand all that the speaker said? Yes____ No____

Was his voice clear? Yes____ No____

Did he use words that you did not know? Yes____ No____

Comments: _____

_____

13. Did what the speaker said fit with what was being shown on the screen? Yes____ No____

Comments: _____

_____

14. Did materials on the Caramate go well with the written materials you have for study and note taking? Yes____ No____

Comments: _____

_____

15. Did you have to ask the instructor many questions? Yes____ No____

Comments: _____

_____

16. Did you use reference notes when you worked in the Lab? Yes____ No____

Did you make new ones? Yes____ No____

Comments: _____

_____

17. Do you feel confident about your performance on the lessons you have completed? Yes____ No____

Comments: _____

_____

Please answer the following questions about your work in the ILC:

18. Were you comfortable? Yes____ No____

Comments: _____

_____

19. Was lighting adequate? Yes____ No____

Comments: _____

_____

20. Were you distracted by noise? Yes____ No____

Comments: _____

_____

21. Did you have enough space to work easily? Yes____ No____

Comments: _____

_____

For Videodisc Delivery System Students (VDSS)

Please answer the following questions about the lessons you have completed with AN/VRC-12 Series Radio Sets:

1. Were you comfortable working with the videodisc in the Lab? Yes____ No____

   Comments: _____

   _____

2. Was lighting adequate in the Lab? Yes____ No____

   Comments: _____

   _____

3. Were you distracted by noise in the Lab? Yes____ No____

   Comments: _____

   _____

4. Did you have enough space to work easily in the Lab? Yes____ No____

   Comments: _____

   _____

5. Was the distance from the videodisc player about right? Yes____ No____

   Was it too close? Yes____ No____

   Was it too far away? Yes____ No____

   Comments: _____

   _____

6. Were the written materials you used easy to understand? Yes____ No____

Did they use too many unfamiliar words? Yes____ No____

Were they confusingly organized? Yes____ No____

Comments: _____

_____

7. Were the diagrams easy to use and understand? Yes____ No____

Comments: _____

_____

8. Did the written materials and diagrams go together well for easy understanding? Yes____ No____

Comments: _____

_____

9. Were all printed materials large enough and clear enough for easy use? Yes____ No____

Were they too small? Yes____ No____

Were they blurry or unclear? Yes____ No____

Comments: _____

_____

10. Was the speed of the videodisc about right? Yes____ No____

Did it go too fast? Yes____ No____

Did it go too slowly? Yes____ No____

Comments: _____

_____

11. Were you bored by the lessons? Yes____ No____

Comments: _____

_____

12. Could you understand all that the speaker said? Yes____ No____

Was his voice clear? Yes____ No____

Did he use words that you did not know? Yes____ No____

Comments: _____

_____

13. Did what the speaker said fit with what was being shown on the screen? Yes____ No____

Comments: _____

_____

14. Did materials on the videodisc go well with the written materials you have for study and note taking? Yes____ No____

Comments: _____

_____

15. Did you have to ask the instructor many questions? Yes____ No____

Comments: _____

_____

16. Did you use reference notes when you worked on the actual radio sets in the Lab? Yes____ No____

Did you make new notes as you worked? Yes____ No____

Comments: _____

_____

17. Do you feel confident about your performance on the lessons you have completed? Yes____ No____

Comments: _____

_____

Please answer the following questions comparing lessons you studied with the Caramate with those you studied with the videodisc:

18. Did you like using the videodisc better than you liked using the Caramate? Yes____ No____

Comments: _____

_____

19. Did you think you learned more quickly with the videodisc? Yes____ No____

Comments: _____

_____

20. Were diagrams as sharp and clear on the videodisc as on the Caramate? Yes____ No____

Comments: _____

_____

21. Did the physical movement (motion) on the videodisc player make course materials learned easier to understand than materials learned with the Caramate player, which has only still pictures? Yes____ No____

Comments: _____

_____

22. Did you use the backward motion capability of the videodisc to review or clarify course material? Yes____ No____

Did you find it helpful? Yes____ No____

Comments: _____

_____

23. Did you use the slow moving speed capability? Yes____ No____

Did you find it helpful? Yes____ No____

Comments: _____

_____

24. Did you use the rapid search of course material capability? Yes____ No____

Did you find it helpful? Yes____ No____

Comments: _____

_____

25. Did you use the videodisc when you were working on actual equipment? Yes____ No____

Did you also use reference notes? Yes____ No____

Did you make new notes at that time? Yes____ No____

Comments: _____

_____

26. Did you ask your instructor more questions when you used the videodisc than when you used the Caramate? Yes____ No____

Comments: _____

_____

27. Do you feel more confident about your performance on materials learned with the videodisc than on those learned with the Caramate? Yes____ No____

Comments: _____

_____

Lab Instructor Questionnaire

Please answer the following questions about study conditions in the Lab.

1. Do student stations in the Lab provide adequate space for working with both the videodisc and radio equipment? Yes____ No____

2. Is lighting adequate for working with the videodisc as well as for working with radio equipment? Yes____ No____

For the following questions, please compare the Lab performance of students who have worked with the Caramate delivery system in the ILC with those who have worked in the Lab using the videodisc system:

3. Have students in one group requested help from the instructor more frequently than those in the other? Yes____ No____
   If yes, which group? Caramate____ Videodisc____

4. Have students in one group seemed to zero in better on specific areas where they need help? Yes____ No____

5. Which system did students seem to like better? Caramate____ Videodisc____

6. Did it appear that one group made more reference notes than the other for later use in the field? Yes____ No____
   If yes, which group? Caramate____ Videodisc____

7. Did one group of students seem to be more confident of their performance levels than the other? Yes____ No____

If yes, which group? Caramate____ Videodisc____

8. Did one group appear to have greater confidence in handling the radio equipment in the Lab? Yes____ No____

If yes, which group? Caramate____ Videodisc____

Comments:_____

Appendix B

Student Guidance Card
Computer Generated Report
Student Personal History
Report of Student Interview
Equipment Inspection and Maintenance
Work Sheet

Date Course Started: ______________________________ 101061CR__________

STUDENT GUIDANCE CARD

Name: ____ Class: ____________

Date	Lesson Number	AV	Exer Nr	Start	Stop	Remarks

FS Form 1051
(CED) 1 Nov 78
Edition of 1 Jan 78 may be used

****
***** PERSONAL IN NATURE
****

NAME	SSN	COMP	PI	CLASS	DATE/TIME
JOHN DOE	000-00-0000	RA	1.1	^ 47-79	30/11/79 09:44:24

TASKS PASSED		POI TIME	AVG TIME	STUD TIME	DATE/TIME LAST TASK
CR2601	ORGANIZATIONAL MAINTENANCE	4.30	1.06	1.00	20/11/79
CR2602	TS-352 FUNCTIONS	10.30	7.01	6.20	1005
CR2603	USE OF THE TS-352	6.12	6.00	5.20	
CR2604	DC CIRCUITS & TEST EQUIPMENT	14.48	12.00	15.32	
CR2605	FREQ. SENSITIVE NETWORKS	16.36	18.00	20.20	
CR2606	SEMICONDUCTORS	10.48	9.00	7.28	
CR2607	T/S THE AN/GRA-39	19.60	15.00	10.20	
CR2608	SIGNAL RECEPTION	4.36	4.00	4.32	
CR2609	RECEIVER T/S (RF STAGES)	8.00	9.05	10.10	
CR2610	RECEIVER T/S (OUTPUT STAGES)	8.00	5.00	4.50	
CR2611	T/S AM RECEIVERS	4.24	5.08	6.45	
CR2612	T/S OF CABLES AND ACCESSORIE	10.00	3.00	2.50	
CR2613	VACUUM TUBE TESTING	6.36	3.03	2.20	
CR2614	TRANSMITTER MAINTENANCE	9.30	6.09	5.20	
CR2615	T/S TRANSMITTER POWER STAGES	6.24	6.07	7.25	
CR2616	T/S AM TRANSMITTER	5.30	7.08	8.05	
CR2617	T/S MEDIUM-POWERED FM RADIO	26.18	34.00	32.40	
CR2618	T/S MEDIUM-POWERED FM RADIO	20.48	26.00	39.15	
CR2619	T/S AN/VRC-12 SERIES RADIOS	18.54	14.00	16.25	
CR2621	T/S AN/GRC-160	18.36	13.02	17.15	
CR2624	T/S AN/VIC-1	17.42	13.00	9.35	
CR2625	T/S AN/VIC-1 WITH RADIO	26.18	15.00	15.45	
CR2626	T/S AN/GRC-106	14.54	13.00	76.23	
CR2628	T/S TT-98	9.12	18.02	22.50	
CR2629	T/S AN/GRC-142	10.42	7.00	10.45	
					GRADUATE
TOTAL		309.48	269.51	359	

****
***** PERSONAL IN NATURE
****

STUDENT PERSONAL HISTORY

(NAME) (CLASS) (MARRIED OR SINGLE)

(IF MARRIED, WHERE IS YOUR WIFE) (NO OF CHILDREN) (WHAT ARE YOUR HOBBIES?)

What do you think of the US Army?

What do you think of Electronics as a career?

What experience have you had with Electronics?

Rate your reading ability: POOR, GOOD, EXCELLENT, SUPERIOR

Rate your ability in mathematics: POOR, GOOD, EXCELLENT, SUPERIOR

Indicate the number of courses you have had in the subjects below:

General Math _____ Chemistry _____

Algebra _____ Electricity _____

Physics _____ Electronics _____

Write a short autobiography (story of your life) covering approximately the last five years. Include such things as schools, jobs, travels, and plans for the future. (Use the back side of this form, if needed.)

FS Form 58
(CED) 1 Feb 78

REPORT OF STUDENT INTERVIEWS

Data Required by the Privacy Act of 1974

The authority for collecting this information is Title 5, United States Code, Section 301.

The principal purpose for collecting this information is to obtain data on the student's military and civilian education experience.

This data will be used by department personnel in providing counseling services to students experiencing academic difficulty during the course of instruction. This form will also be used to record the student's grades and counselor's comments or recommendations.

This record will be maintained as a related document in the student's academic record for one year after the end of the course, at which time the record will be destroyed.

Disclosure of the requested information is voluntary. The student will lose no rights or benefits to which entitled by law for failing to provide the information.

(SECTION I TO BE COMPLETED BY STUDENT PRIOR TO FIRST INTERVIEW)

Section I

_____ _____ _____ _____
(Name) (Rank) (SSN) (Branch of Svc)

_____ _____ _____ _____
(Age) (Nation., if Allied) (Status, NG, RA, ER) (Class)

_____ _____
(Source and Date of Commission) (Date of Rank)

SUMMARY OF ACTIVE DUTY MILITARY EXPERIENCE

Type of Unit	Duty	Mos in duty	Yr duty compl	Overseas Theater

Civilian Education:

Highest grade of school completed: _____ Year completed: _____
Vocational School Attended: _____ Subject: _____
College attended _____ Date and Degree: _____

Check subjects you have studied:

____College Algebra	____Trigonometry	____Eng Drawing	____Solid Geometry
____Elementary Algebra	____Calculus	____Topo Drawing	____Elementary Electricity
____Plane Trigonometry	____Physics	____Mech Drawing	____Meteorology

Indicate civilian experience in the following fields:

____Surveying	____Drafting	____Accounting	____Mechanics
____Radar	____Meteorology	____Teaching	
____Electronics	____Computing	____Mathematics	

MILITARY EDUCATION:
Formal courses and dates attended: (Indicate if completed). _____ _____

_____

_____

ADDITIONAL INFORMATION:
Are you a pipeline student (Bnl only)?_____. Did you volunteer for this course?_____.
Total time spent on study daily?_____. Have you requested or attended any extra instruction?_____.
How much?_____. Do you intend to make the Army a career?_____. Do you desire to become an instructor?_____. Have you ever been an instructor in a service school?_____. -if so details: _____. Do you have any handicaps or personal problems which should be considered? _____ -If so what: _____.
Your opinion (or complaints) of the instruction: _____.
Your reason (or opinion) for below standard work: _____.
_____.

_____ _____ _____
(Student's Signature) (Rank) (SSN)

DD Form 412
(REV) 1 Mar 76

STUDENT — DO NOT COMPLETE ANY ITEMS ON THIS PAGE.

SECTION II

(SECTION II TO BE COMPLETED BY CONCERNED SECTION)

Aptitude Scores: EL:_____ GT:_____ Alg:_____

GRADES TO DATE:

Examination	Grade	Examination	Grade	Examination	Grade	Examination	Grade

CREDIT HOURS_____ SUBJECTS previously failed:_____

SECTION III

Student qualities: (P-Poor, F-Fair, G-Good, E-Excellent, S-Superior)

Interview:	First	Second	Third	Fourth	Fifth
Manner:					
Appearance:					
Mentality:					
Attitude:					
Application:					

General value to service: (D-Doubtful, Bl-Below Avg, A-Avg, Al-Above Avg)

Interview:	First	Second	Third	Fourth	Fifth

Recommendations: (C-Continue, TB-Turnback, R-Relieve)

	First	Second	Third	Fourth	Fifth

Interviews:

Interview No_____ Reason:_____ Date_____
Comments:_____

(Signature) (Rank) (Supv's Initials)

Interview No_____ Reason:_____ Date_____
Comments:_____

(Signature) (Rank) (Supv's Initials)

Interview No_____ Reason:_____ Date_____
Comments:_____

(Signature) (Rank) (Supv's Initials)

Interview No_____ Reason:_____ Date_____
Comments:_____

(Signature) (Rank) (Supv's Initials)

Interview No_____ Reason:_____ Date_____
Comments:_____

(Signature) (Rank) (Supv's Initials)

4021 Army-Fort Sill, Okla.

EQUIPMENT INSPECTION AND MAINTENANCE WORKSHEET

For use of this form, see TM 38-750; the proponent agency is the Office of the Deputy Chief of Staff for Logistics.

1. ORGANIZATION	2. NOMENCLATURE AND MODEL

3. REGISTRATION/SERIAL/PIN	4a. MILES	b. HOURS	c. ROUNDS FIRED	d. HOT STARTS	5. DATE	6. TYPE INSPECTION

7. APPLICABLE REFERENCE

TM NUMBER	TM DATE	TM NUMBER	TM DATE

INSTRUCTIONS - Perform each check listed in the TM applicable to the inspection performed. Following the sequence listed in pertinent TM, complete form as follows:

COLUMN a - Enter TM item number.

COLUMN b - Enter the applicable condition status symbol.

COLUMN c - Enter deficiencies and shortcomings.

COLUMN d - Show corrective action for deficiency or shortcoming listed in Column c.

COLUMN e - Individual ascertaining completed corrective action initial in this column.

ALL INSPECTIONS AND EQUIPMENT CONDITIONS RECORDED ON THIS FORM HAVE BEEN DETERMINED IN ACCORDANCE WITH DIAGNOSTIC PROCEDURES AND STANDARDS IN THE TM CITED HEREON.

8a. SIGNATURE (Person(s) performing inspection)	8b. TIME	9a. SIGNATURE (Maintenance Supervisor)	9b. TIME	10. MAN-HOURS REQUIRED

TM ITEM NO. a	STATUS b	DEFICIENCIES AND SHORTCOMINGS c	CORRECTIVE ACTION d	INITIAL WHEN CORRECTED e

DA, FORM JAN 66 2404

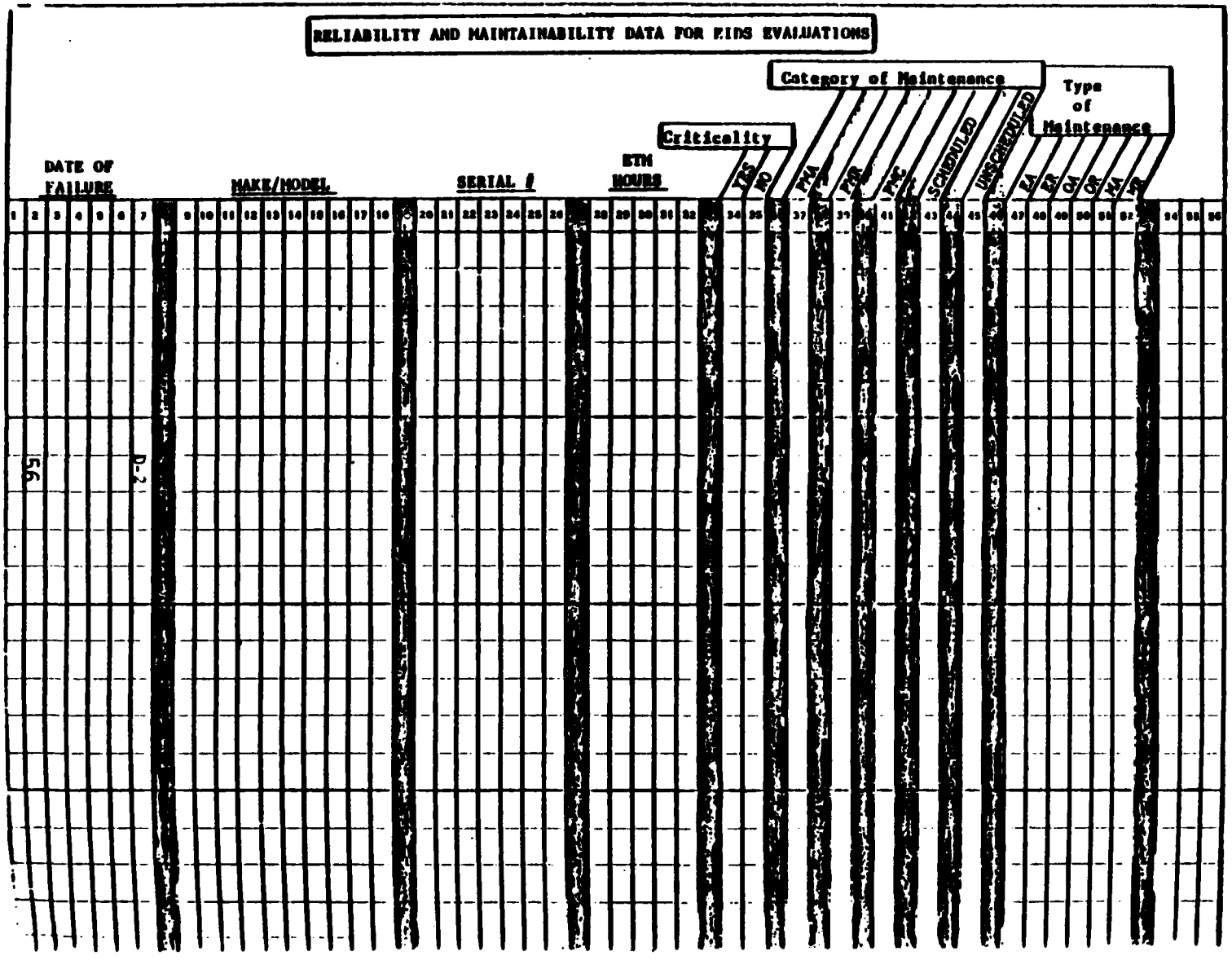
TM ITEM NO. a	STATUS b	DEFICIENCIES AND SHORTCOMINGS c	CORRECTIVE ACTION d	INITIAL WHEN CORRECTED e

☆ U.S. GOVERNMENT PRINTING OFFICE: [illegible]

Appendix C

Reliability and Maintainability Data For EIDS Evaluation

Maintenance and Cost Data For EIDS Evaluation


RELIABILITY AND MAINTAINABILITY DATA FOR F.I.D.S EVALUATIONS
Category of Maintenance
Type of Maintenance
Criticality
DATE OF FAILURE
MAKE/MODEL
SERIAL #
BTH HOURS
YES
NO
PMA
PMB
PMC
SCHEDULED
UNSCHEDULED
EA
EB
OA
OB
MA
MB
56
D-2

RELIABILITY AND MAINTAINABILITY DATA DEFINITIONS FOR EIDS MAINTENANCE

There is no strict format for filling out this data sheet. Just insure that everything is legible and correct. If you desire to use a decimal point within any number, accentuate it so that it is clearly visible.

Date Repair Complete - Enter the date that the repair was completed.

Hours to Repair - Enter the numbers of hours the maintenance technican devoted to the repair of this equipment.

Serial Number - Enter the serial number of the player that has failed or requires preventative maintenance.

Maintenance Labor Cost - Enter the salary paid the maintenance technican for the repair of this equipment.

Maintenance Parts Cost - Enter the cost of repair parts required to repair this equipment.

Admin Hours - Enter the number of hours required to administratively process the equipment.

Admin Costs - Enter the cost of administratively processing this equipment.

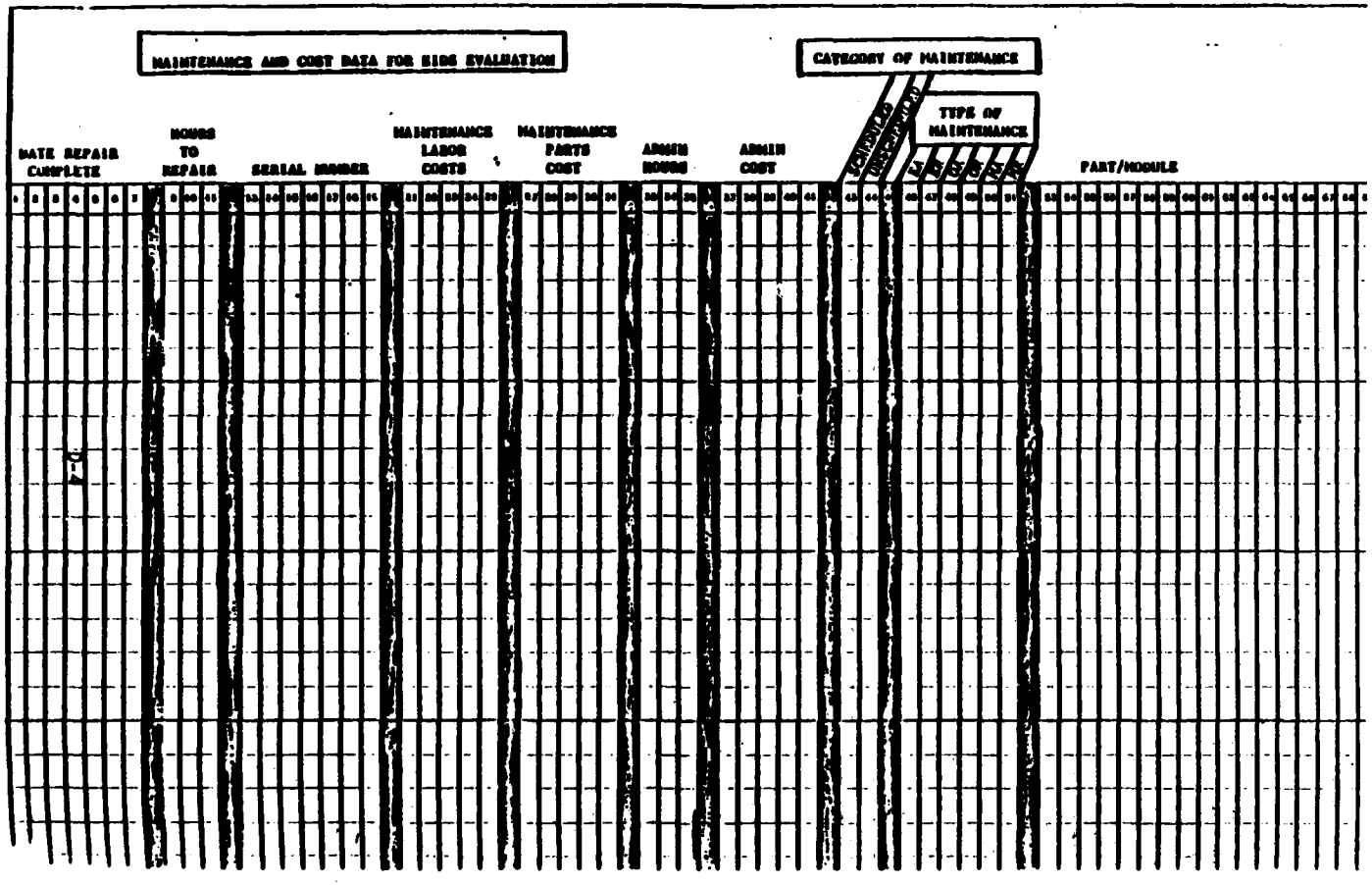
Category of Maintenance - For this data the maintenance technician will c of the following categories:

Scheduled - If this was scheduled maint this block
Unscheduled - If this was unschedule check this block

Type of Maintenance - Please check the following types of ma

EA - Electrical Adjust
ER - Electrical Replace
OA - Optical Adjust
OR - Optical Replace
MA - Mechanical Adjust
MR - Mechanical Replace

Parts/Module - Enter the name of the part/modul required repair.


MAINTENANCE AND COST DATA FOR SIDS EVALUATION
CATEGORY OF MAINTENANCE
TYPE OF MAINTENANCE
DATE REPAIR COMPLETE
HOURS TO REPAIR
SERIAL NUMBER
MAINTENANCE LABOR COSTS
MAINTENANCE PARTS COST
ARMIN HOURS
ARMIN COST
PART/MODULE

RELIABILITY AND MAINTAINABILITY DATA DEFINITIONS FOR EIDS EVALUATIONS

There is no strict format for filling out this data sheet. Just insure that everything is legible and correct. If you desire to use a decimal point within any number, accentuate it so that it is clearly visible.

Date of Failure - Enter the date that the failure was first observed. Example: 25 Dec 79.

Make/Model - Please just enter the make/model of the system being evaluated.

Serial Number - Enter the Serial Number of the player that has failed or requires preventative maintenance.

ETM Hours - Enter the hours registering on the elapse time meter at the time of the failure or preventative maintenance.

Criticality - Check "yes" if this failure is a critical mission stoppage failure. Check "no" if this failure is not a critical mission failure. The definition of the mission failure is one that would make training on this system impossible. Criticality will require a subjective decision by the test monitor. As an example, for most lessons the use of color is not required and the loss of color would not stop the system from delivering training materials; however, certain training materials require color and the loss of that color would result in a critical failure of the system to deliver its intended mission - training. The monitor will make his decision on a case by case basis.

Category of Maintenance - For this data the monitor will check all categories that apply:

PMA - Preventative Maintenance Adjust
PMR - Preventative Maintenance Replace
PMC - Preventative Maintenance Clean
Scheduled - If this was scheduled operator preventative maintenance check this block
Unscheduled - If this was unscheduled operator preventative maintenance check this block

Type of Maintenance - Please check the following types of maintenance that apply:

EA - Electrical Adjust
ER - Electrical Replace
OA - Optical Adjust
OR - Optical Replace
MA - Mechanical Adjust
MR - Mechanical Replace

D-5

Appendix D

Selected Computer Output

Appendix D

This appendix gives selected computer output of the regression analyses. On the first page, the SPSS[1] procedure file is listed. Line 5 gives the list of variables:

T	Treatment (1=videodisc, 0=Caramate)
E	Self report by trainee of highest level of education he/she attained.
R	Estimate of reading by trainee on a 5-point scale.
G	GT-ASVAB score.
EL	EL-ASVAB score.
A7-A9	Active time in hours on Tasks 17, 18, 19.
P	Overall course PI (not used in analyses).
PF7-PF9	Number of failures on enabling examinations for Tasks 17, 18, 19.
K	Knowledge Retention Test score.
A	Acceptance Questionnaire score.

The remaining lines provide the following information and instructions:

Line 10 - Input format for the data file.
Line 15 - Instruction to consider blanks as missing data.
Line 20 - Set all pass/fail values to 1 or 0.
Line 25 - Compute PI for Task 17.
Line 30 - Compute treatment by education interaction variable (TE)
Line 35 - Instruction to consider blanks in PI and TE as missing data.
Line 40 - Regress PI on T, E, and TE. Regress PI on T and E.

The output listing at the bottom of the first page shows the results of regressing PI for Task 17 on T, E, and TE. The overall F-ratio was statistically significant but no one of the main effects or the interaction was significant. This resulted because of the high degree of colinearity of the interaction with the main effect terms.

The output listed at the top of the second page shows the results of regressing PI for Task 17 on only the main effects T and E. Both effects are statistically significant and the difference of the adjusted PI means is -.178.

---

[1] Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., and Bent, D. H. Statistical Package for the Social Sciences (2nd ed.; New York: McGraw-Hill, 1970).

The remaining listings are for the analyses of active time on Tasks 18 and 19, the Knowledge Retention test and the Acceptance Questionnaire. Only the results of the analyses involving the two main effects are given. Analyses for these dependent variables that included the interaction term all produced findings that were essentially the same as those for the PI for Task 17.

```
SPSS/ONLINE AUTO-MODE
* list
   5.     VARIABLE LIST
   5.005  T,E,R,G,EL,A7,A8,A9,P,PF7,PF8,PF9,K,A
  10.     INPUT FORMAT
  10.005  FIXED(4X,F1.0,F3.0,F2.0,2F4.0,3F5.0,F4.0,1X,3F1.0,2F3.0)
  15.     MISSING VALUES
  15.005  T TO A(BLANK)
  20.     RECODE
  20.005  PF7 TO PF9(0=0)(BLANK=BLANK)(ELSE=1)
  25.     COMPUTE
  25.005  PI=A7/2618
  30.     COMPUTE
  30.005  TE =T*E
  35.     ASSIGN MISSING
  35.005  PI,TE(BLANK)
  40.     REGRESSION
  40.005  VARIABLES=T,E,R,PI,TE/
  40.006  REGRESSION=PI WITH T,E,TE/REGRESSION=PI WITH T,E/
  40.007  REGRESSION=PI WITH T,E,R


DEP. VAR... PI

MEAN RESPONSE        1.71790      STD. DEV.        .57987

FINAL STEP.

MULTIPLE R     .2082 ANOVA          DF  SUM SQUARES  MEAN SQ.      F
R SQUARE       .0434 REGRESSION      3.       3.397     1.132    3.474
STD DEV        .5709 RESIDUAL      230.      74.950      .326 SIG. .017
ADJ R SQUARE   .0309 COEFF OF VARIABILITY    33.2PCT

VARIABLE        B       S.E. B       F       SIG.      BETA    ELASTICITY

T               .778       .694     1.258   .263      .62058     .13935
E              -.027       .037      .507   .477     -.06021    -.18484
TE             -.080       .058     1.924   .167     -.76501    -.16976
CONSTANT       2.088       .451    21.422   .000

ALL VARIABLES ARE IN THE EQUATION.
```

DEP. VAR... PI

MEAN RESPONSE 1.71790 STD. DEV. .57987

FINAL STEP.

MULTIPLE R	.1880	ANOVA	DF	SUM SQUARES	MEAN SQ.	F
R SQUARE	.0353	REGRESSION	2.	2.770	1.385	4.233
STD DEV	.5720	RESIDUAL	231.	75.577	.327	SIG. .016
ADJ R SQUARE	.0270	COEFF OF VARIABILITY		33.3PCT		

VARIABLE	B	S.E. B	F	SIG.	BETA	ELASTICITY
T	-.178	.081	4.772	.030	-.14164	-.03181
E	-.060	.029	4.387	.037	-.13580	-.41689
CONSTANT	2.489	.347	51.463	0		

ALL VARIABLES ARE IN THE EQUATION.

DEP. VAR... AB

MEAN RESPONSE 2593.79111 STD. DEV. 768.83736

FINAL STEP.

MULTIPLE R	.1701	ANOVA	DF	SUM SQUARES	MEAN SQ.	F
R SQUARE	.0289	REGRESSION	2.	3829608.095	.19E+07	3.306
STD DEV	761.0425	RESIDUAL	222.	.1285E+09	.57E+06	SIG. .038
ADJ R SQUARE	.0202	COEFF OF VARIABILITY		29.3PCT		

VARIABLE	B	S.E. B	F	SIG.	BETA	ELASTICITY
T	277.611	110.375	6.326	.013	.18687	.03282
E	-12.854	38.423	.112	.738	-.02219	-.05931
CONSTANT	2662.503	466.547	32.568	.000		

ALL VARIABLES ARE IN THE EQUATION.

DEP. VAR... A9

MEAN RESPONSE 1376.10222 STD. DEV. 731.96939

FINAL STEP.

MULTIPLE R	.0799	ANOVA	DF	SUM SQUARES	MEAN SQ.	F
R SQUARE	.0064	REGRESSION	2.	765368.267	.38E+06	.712
STD DEV	732.9109	RESIDUAL	222.	.1192E+09	.53E+06	SIG. .492
ADJ R SQUARE	0	COEFF OF VARIABILITY		53.3PCT		

VARIABLE	B	S.E. B	F	SIG.	BETA	ELASTICITY
T	97.893	106.295	.848	.358	.06181	.02182
E	30.703	37.002	.689	.408	.05569	.26705
CONSTANT	978.596	449.301	4.744	.030		

ALL VARIABLES ARE IN THE EQUATION.

DEP. VAR... K

MEAN RESPONSE 44.68376 STD. DEV. 5.09253

FINAL STEP.

MULTIPLE R	.1400	ANOVA	DF	SUM SQUARES	MEAN SQ.	F
R SQUARE	.0196	REGRESSION	2.	118.493	59.247	2.310
STD DEV	5.0641	RESIDUAL	231.	5924.105	25.645	SIG. .102
ADJ R SQUARE	.0111	COEFF OF VARIABILITY		11.3PCT		

VARIABLE	B	S.E. B	F	SIG.	BETA	ELASTICITY
T	-.202	.720	.078	.780	-.01831	-.00139
E	.532	.253	4.414	.037	.13734	.14235
CONSTANT	38.385	3.071	156.183	0		

ALL VARIABLES ARE IN THE EQUATION.

DEP. VAR... A

MEAN RESPONSE 14.10256 STD. DEV. 2.26139

FINAL STEP.

MULTIPLE R	.3293	ANOVA	DF	SUM SQUARES	MEAN SQ.	F
R SQUARE	.1084	REGRESSION	2.	129.170	64.585	14.043
STD DEV	2.1445	RESIDUAL	231.	1062.369	4.599	SIG. .000
ADJ R SQUARE	.1007	COEFF OF VARIABILITY		15.2PCT		

VARIABLE	B	S.E. B	F	SIG.	BETA	ELASTICITY
T	1.581	.305	26.900	0	.32331	.03449
E	-.071	.107	.436	.510	-.04117	-.06004
CONSTANT	14.463	1.301	123.643	0		

ALL VARIABLES ARE IN THE EQUATION.

END

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